Summary of test observations – E041 BEA LZR

Behavior of the BEA - LZR regarding climate conditions

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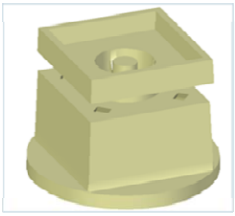
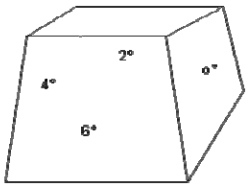
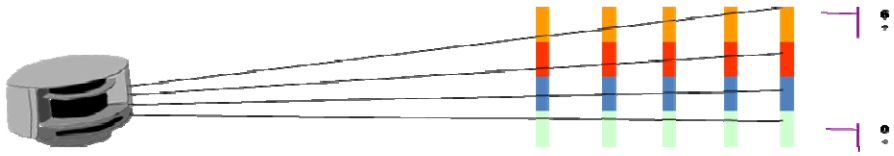
1 More information than other types of Laserscanner:

The presence of four curtains provides for the same distance and same angle of detection, four different information.

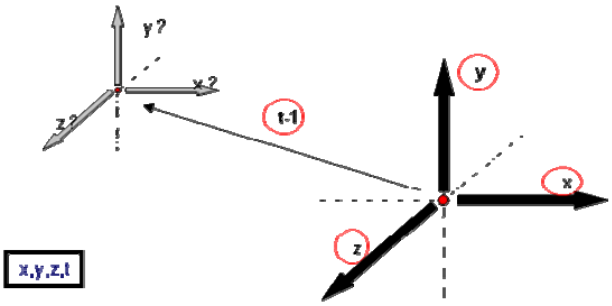






This gives a certain "weight" to the detected object. Indeed it is possible to differentiate between an object, like a raindrop, that will be seen in an instant 't' only on one of the four planes and a larger object that will affect all levels. The limitations of this weight will obviously depend on the application and are set through the detection algorithms.

Similarly it is possible to verify on a plane how many points are repeated at the same distance from the Laserscanner and define the "width" of the object in question.



A third information is the ability to remember the state of the previous scan and verify if the situation "t" is equivalent to the situation "t-1". A small object (like rain, snow,…) that crosses the area will therefore also be filtered.

2 Tests performed with snow:

We have two parallel conditions:

- On one side the Laserscanner has to filter the snow to avoid erratic detections.
- On the other side, the Laserscanner still must detect the different testbodies behind the snow.

If, regarding the snow density, the Laserscanner is not able anymore to fulfill both conditions, it goes into a safety state to avoid any accidents.

3 Tests performed with fog:

We face again the same principle, define algorithms to filter the fog and ensure the detectivity of the reference body which is behind.

- On one side the Laserscanner has to filter the fog to avoid erratic detections.
- On the other side, the Laserscanner still must detect the different testbodies behind the fog.

If, regarding the fog density, the Laserscanner is not able anymore to fulfill both conditions, it goes into a safety state to avoid any accidents.
When we start to get some fog, reducing the "quantity of energy" emitted by the laser diode is also a way to increase even more the limits of detection.

The field experience of the laserscanner during the past two years shows that this threshold is in practice rarely achieved.

4 Tests performed with sunlight:

Globally the Laserscanner is not perturbed by the Sunlight. The Laserscanner has some applications where it has to work horizontally and detect the approach and presence of vehicles. So it has to be quite immune regarding the headlights of the vehicles. Nevertheless, tests have shown that in some particular positions to the sun, some erratic detection may be caused by the sunlight. This is the case of every optical solution and has to be taken into account regarding the installation.

5 Hardware design for outside installations

Regarding the hardware level, the product has been designed specifically for outdoor applications. This is reflected particularly by the presence of:
- An IP65 housing
- An optical isolation between the "emitter" and the "receiver". This prevents an optical short circuit if a small dust is positioned on the windows.

A detector as in the photos attached (extreme case) is always capable of detecting an object of a certain size without entering in detection. Again, the limit has to be defined by the application:

6 Global conclusion

As a conclusion, the laserscanner developed by BEA is particularly well suited for outdoor use. The first experience of some hundreds of parts installed on the field comforts us in this position.